

THE
BIOLOGIST



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PHI SIGMA SOCIETY

An Organization Devoted to the Promotion of Interest in Research
in the Biological Sciences, Founded Ohio State
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THE NEW COVER

Several changes in the format of the BIOLOGIST were approved by the last convention. It seems wise to make as many of these proposed changes at one time as possible. Hence beginning with this issue (the first number of a new volume) the dimensions have been somewhat decreased to a standard size with a view toward economy necessitated by the greater expense of quarterly publication; a less expensive but good quality white eggshell paper is used; each number is held to a maximum of 32 pages; and a new cover design appears.

For sometime the National Council has thought that the BIOLOGIST would be improved by a cover design which would be actually significant and full of meaning. The Editor earnestly hopes that most of the members of Phi Sigma really like the new cover. The border was drawn by Miss Celeste Whaley (Omega '28), artist and technician of the Zoology Department, at the University of Oklahoma. It was made under the direction of the National President and of the Secretary-Editor. It was designed to represent by well-known examples all of the major animal and plant groups and certain of the more important subsciences in the biological field.

We sincerely trust that individual members will be interested enough in this design to attempt to name each animal, plant, or unit in its make-up. Please send to the Editor your list of the component parts to reach him not later than October 10. In the next issue of the BIOLOGIST the complete list will be published, and the names of the members whose lists are most nearly correct. In some instances diagrams or apparatus, rather than actual animals or plants are used to represent certain fields of biology. These should be noted.

The type now used on the cover and headings is Goudy Hand Tooled. Eventually our new coat-of-arms will replace the present one.

Any criticisms or suggestions will be greatly appreciated. *This is your publication—help improve it.*

—A. I. O.

THE BIOLOGIST

WOODS HOLE NUMBER

VOLUME XI

SEPTEMBER, 1929

NUMBER I

SOME OF THE FUNCTIONS AND FEATURES OF A BIOLOGICAL STATION

By C. O. Whitman

INTRODUCTORY NOTE

The address reprinted here was delivered in 1897 before the Ithaca meeting of the Society of American Naturalists by the first director of the Marine Biological Laboratory.

Although Agassiz actually started the Laboratory at Penikese, Doctor Whitman is considered the Founder of the Marine Biological Laboratory at Woods Hole. Doctor Whitman who died in 1905 was for a long time head of the Department of Zoology at the University of Chicago. In view of the fundamental and much debated question as to the value of the various courses of instruction at Woods Hole, it seems of especial interest to reprint in full Doctor Whitman's address. So much of what he outlined has become a reality at the Marine Biological Laboratory in the last 32 years that there seems to be no need of newer statements. This address is reproduced with special permission of the publishers, Messrs. Ginn and Company, from their volume of "Biological Lectures, 1896-1897".

The attention of all readers is called to fact that in Volume VIII, No. 1, May, 1926, of the *BIOLOGIST*, there appeared an article concerned with the Marine Biological Laboratory written by the present National Vice-President, Dr. A. M. Keefe. All interested in Woods Hole will find this description most instructive.

The Editor wishes to express his appreciation and give full credit to Doctor Keefe who so kindly obtained and sent the following paper for publication.

I have a few considerations to offer on a subject not quite new, but perhaps not without some interest to a society of naturalists. The subject may be stated in the form of a question: What are some of the more essential functions and features to be represented in a biological station? This question is one that may fairly claim the attention of a society organized for "the discussion of methods of investigation and instruction, and other topics of interest to investigators and teachers of natural history; and for the adoption of such measures as shall tend to the advancement and diffusion of the knowledge of natural history."

I know of no other organization in this country in which the different sides of biology are more fully and widely represented, and no other in which the discussion of such questions as I have stated has been more explicitly invited.

The question before us, as you perceive, is one of ideals,—something which we can construct without the aid of an endowment, and probably without any permanent loss of protoplasm. And yet, what I have in mind is not wholly imaginary, for it has some basis in experience and in acquaintance with some of the best models.

Let us first of all try to get at some general principle which may serve to guide our judgment of ideals, and by the aid of which we may be able to formulate an answer to the question proposed.

As all will allow, ideals are absolutely indispensable to progress and always safe, provided they are kept growing. Like all biological things, live ideals originate by germination, and their growth is subject to no limit except in mental petrification. Growth and adaptability are as natural and necessary to them as to living organisms. Here we have, then, an unfailing test for the soundness or relative merit of ideals. Seeds may be kept for years without sensible change or loss of power to germinate. But it is because they are kept, not planted and cultivated. Once planted they must grow or rot. So it is with ideals. The unchanged ideal that we sometimes hear boasted of is at best but a dormant germ, not a plant with roots and branches in functional activity. If an ideal stands for anything which is growing and developing, then it must also grow, or be supplanted by one that will grow. It is easy, of course, to conceive of ideals a hundred years or more ahead of possible realization; but such ideals could have no vital connection with present needs, and long before the time of possible realization, they would cease to be the best, even if the best conceivable at the start.

We are here, then, concerned only with ideals rooted in experience and continually expanding above and in advance of experience. The moment growth ceases, that moment the work of the ideal is done. Something fails at the roots, and you have waste mental timber to be cleared away as soon as possible to make room for the new seed.

Let us here take warning of one danger to which we are all liable,—the danger of adopting ideals and adhering to them as finalities, forgetting that progress in the model is not only possible, but essential to progress in achievement. The danger is all the greater in the case of ideals lying outside our special field of work, which we are unable to

test and improve by our own efforts. The head may thus become stored with a lot of fixed mental furniture, and the possessor become the victim of an illusion, from the charms of which it is difficult to disenchant him. He falls into admiration of his furniture, taking most pride in its unchangeableness. It was, perhaps, the best to be found in the market at the time of installment, and he finds pleasure in the conceit that what *was* the best is and must remain the best. He sees new developments in the market, but his pride and inertia content him with the old. The illusion now takes full possession of him, and every departure from his new ideals seems like abandonment of the higher for the lower standard of excellence. His conceit grows instead of his ideals, and every annual ring added to its thickness renders it the more impervious.

Can any one say he has never met this illusion? Then a warning may have more pertinency than I should have ventured to claim for it.

To conclude these introductory remarks, let me again emphasize the all-important qualification of the sound ideal and name the prime condition of its usefulness. The qualification is vitality and the capacity for unlimited growth and development. The condition is absolute freedom for growth in all directions compatible with the symmetrical development of the science as a whole. Please remember that the question of means does not now concern us. We must first get at principles, leaving details of execution to be worked out afterwards in harmony therewith. No one can foresee what means may be found, and it would be a waste of time to try to decide what should be done under this, that, or the other set of conditions. If we know our ideal, we know the direction of effort, and through the effort, the means are eventually found.

It will help us in the formulation of our ideal if we glance a moment at the ideals that have found most favor. The best models of marine laboratories ten years ago all agreed in making research the exclusive aim, and in limiting the work to marine forms. In most cases the work was still further limited, embracing only marine zoology, and often only a small portion of that field. The idea of representing all branches of even marine biology was seriously entertained nowhere except at Naples. Remembering that marine laboratories were first introduced only about a quarter of a century ago, we are not surprised at these limitations. Even the narrowest limitations were extensions beyond what had been done before. The Naples station itself began as a zoological station, and still bears the name Stazione Zoologica. But the earlier ideal was not long in expanding so as to include both physiology and botany. Will its growth stop there? I do not believe it will, but that remains to be seen.

Our own seaside schools, introduced by Louis Agassiz at Penikese and continued by Professor Hyatt at Annisquam, combined instruction with research, and this plan was adopted at Woods Hole in 1888. Instruction, however, was accepted more as a necessity than as a feature desirable in itself. The older ideal of research alone was still held to be the highest, and, by many, investigation was regarded as the only legitimate function of a marine laboratory. Poverty compelled us to go beyond that ideal and carry two functions instead of one. The result has been that some of us have developed an ideal of still wider scope, while others stand, as they began, by their first choice.

We have, then, two distinct types of ideals, the one including, the other excluding instruction. One is preferred for being limited to investigation; the other is claimed to be both broader and higher for just the contrary reason,—that it is not limited to investigation. At first sight it might seem that we had exact contraries; but that is really not the case, for one type actually includes the other, and differs from it only by the *more* which it contains. The difference is, nevertheless, an important one, as it divides opinion, we must examine it.

To my mind nothing but experience can settle such a question; but if reason and experience coincide, so much the better, so we may consider it from both points of view. On the basis of ten years' experience and a previous intimate acquaintance with both types, I do not hesitate to say that I am fully converted to the type which links instruction with investigation: and I believe that many, if not most, of my colleagues in the work at Woods Hole which now concur with me in the opinion that we could not wisely exclude instruction, even if made free to do so by an ample endowment. Some of you will probably feel that such a conclusion implies a step backward rather than forward. On which side is the illusion? Is it with those who have accepted their ideal secondhand and held to it unchanged from the time of its adoption, or with those who have been compelled to develop their own ideal from all that they could learn by actual experiment and study? Which is the broader ideal, and with which are the possibilities for progressive growth least limited?

In which consists the argument for limitation to research? I have yet to learn of a single important advantage which is necessarily dependent upon this limitation. Is instruction a burden to the investigator, which interferes with his work? That objection is frequently raised, and

it is about the only one that we need stop to consider here. That instruction interferes with investigation when it is so arranged as to absorb all or the larger share of one's time no one will deny; but is it not easy to so divide the time that the investigator will find rest and improvement from the instruction he gives? Certainly it is possible, as we have fully demonstrated at Woods Hole and that, too, with only the most limited means. With a laboratory open throughout the year, the investigators connected with it would scarcely feel a few weeks' instruction as an impediment. Not only have we shown that such an accommodation or adjustment of functions is possible and tolerable even in our vacations, but we have also learned that there are some important advantages growing out of it which are impossible under limitation to research. To my mind these advantages far outweigh any and all possible objections.

The advantages that I have in mind are not those of means for running the laboratory, which could be supplied by an endowment, but those which add directly to the progress of the investigator and to the advancement of his work. If important advantages exist in connection with instruction even where there is no endowment, which are not available with an endowment, where instruction is excluded we can readily make our choice of types.

I suppose no investigator, not even the most confirmed claustrophil, would deny that instruction compels thinking and improves ability to express ideas as well as to describe facts. So does writing; so does investigation itself. True, and if that is to their credit, it must be the same to instruction. But wherein is the advantage with instruction? Every teaching investigator can answer that; and the answer will be, that power of exposition can be acquired and perfected by class work and lectures to an extent otherwise unattainable. In this we need no better example than Huxley. If rare powers of exposition are sometimes gained without teaching, as in the case of Darwin, that in no way weakens the position here taken, which is that teaching is the most effective method,—not the only one, yet an essential one to the highest attainment.

One thing more on this point. Why do we place so high a value on investigation? Because it is the only way of advancing knowledge, and because it affords a most attractive field for the exercise of the mind. But if knowledge needs advancement, so does the investigator, and whatever contributes to the increase and improvement of his powers makes him the better investigator, and thus indirectly raises the quality and augments the quantity of his researches. Herein instruction plays a

very important part, as becomes evident when we remember that with increasing specialization in science the investigator himself becomes more and more dependent upon the instruction which he draws, not only from books and journals, but also directly from his colleagues and his pupils. Indeed, he may learn in this way much quicker and more thoroughly than by reading, and often a long time in advance of publication. That is an immense advantage realized in a variety of ways, as in lectures giving the more important results of work before publication; in seminars where the results of individual investigators are brought forward and discussed, while the work is still in progress; in journal clubs devoted to reviews and discussions; in direct intercourse with pupils, seeing with their eyes and working with their hands; in daily intercourse of thought and comparison of observations with fellow-workers, etc. Indeed, it may be truly said that no one stands in such close and pressing need of continual instruction as the investigator. No one else absorbs it more eagerly and copiously, and no one else can convert it so directly into the results of research.

Another advantage supplied by instruction must be mentioned here, for in it I see opportunities for development of far-reaching importance to research. It is lamentable to see so much energy available for research lost or ineffective for lack of proper directive coordination. The avalanche of modern biological literature consists largely of scrappy, fragmentary, disconnected products of a multitude of investigators, all working as so many independent individuals, each snatching whatever and wherever he can, and then dumping his heterogeneous contributions into the common hodge-podge. How are we ever to extricate ourselves from such appalling confusion? The ambition to be prolific rather than sound is a peril against which we seem to have no protection at present. And yet, if I mistake not, there is a growing sentiment against such traffic in science, which will eventually make it plain that ambition in that direction spends itself in vain. A dozen or more dumps a year, with as many or more retractions, corrections, and supplements, is only a modest sized ambition. Conclusions are palmed upon the unsuspecting reader, and then, without compunction or apology, reversed from day to day or from month to month, or, worse still, in an appendix subjoined, so that it may be seen how little it costs to be prolific when one day's work cancels another.

It behooves us to find effective remedies as rapidly as possible. The correction would be complete if each worker could bridle his lust for

notoriety and take the lesson of Darwin's industry and reservation into his laboratory and study. The outlook for such a millennial dispensation is not very hopeful, and our resources are few and very inadequate, but all the more deserving of attention. The great need is *long-continued, concentrated, and coordinated work*. In a laboratory which draws beginners in investigation in considerable numbers, it is possible to assign problems in such a way that the participants may work in coordinate groups, and the problems be carried on from year to year, and from worker to worker, each performing his mite in conjunction and relation with the others of his group. In this way energy would be utilized to the greatest advantage to science, as well as to the individual. Even under the very imperfect conditions represented at Woods Hole, I have found it possible to put this idea into practice to some extent, and I have great faith in its efficacy. Herein we see another possibility of development realizable only through instruction.

But it is as important for independent investigators as for beginners to cultivate organic unity in their work. How shall the investigator hope to keep in touch with the multiplying specialties of his science? Here again I maintain that instruction is an indispensable means. Fill a laboratory with investigators and, if no instruction is provided, many of the more important avenues of acquisition will be closed and the opportunities for coordination of work will be of little or no avail. Investigators might work for months in adjoining rooms and never learn anything about each other's work, as every one knows who has worked in such a laboratory. How different in a laboratory where instruction is so arranged as, without overtaxing any one, to bring the workers into active and mutually helpful relations, and enable them to draw from one another the best that each can give! Instruction in the various forms before indicated supplies just the conditions most favorable to interchange of thought and suggestion. It is just this feature of our work at Woods Hole to which we are most indebted for whatever success we have had.

I am aware that other points might be raised, but it is far from my purpose to run down all possible objections. It is enough to have indicated the grounds of my choice of types. It now remains to briefly sketch the general character and to emphasize some of the leading features to be represented in a biological station.

The first requisite is capacity for growth in all directions consistent with the symmetrical development of biology as a whole. The second

requisite is the union of the two functions, research and instruction, in such relations as will best hold the work and the workers in the natural coordination essential to scientific progress and to individual development. It is on this basis that I would construct the ideal and test every practical issue.

A scheme that excludes all limitations except such as nature prescribes is just broad enough to take in the science, and that does not strike me as at all extravagant or even as exceeding by a hair's breadth the essentials. Whoever feels it an advantage to be fettered by self-imposed limitations will part company with us here. If anyone is troubled with the question, of what use is an ideal too large to be realized? I will answer at once: It is the merit of this ideal that it can be realized, just as every sound ideal can be realized, only by gradual growth. An ideal that could be realized all at once would exclude growth and leave nothing to be done but to work on in grooves. That is precisely the danger we are seeking to avoid.

The two fundamental requisites which I have just defined scarcely need any amplification. Their implications, however, are far-reaching, and I may therefore point out a little more explicitly what is involved. I have made use of the term "biological station" in preference to those in more common use, for the reason that my ideal rejects every artificial limitation that might check growth or force a onesided development. I have in mind, then, not a station devoted exclusively to zoology, or exclusively to botany, or exclusively to physiology; not a station limited to the study of marine plants and animals, not a lacustral station dealing only with land and fresh-water faunas and floras, not a station limited to experimental work, but a genuine *biological* station, embracing all these important divisions absolutely free of every artificial restriction.

Now that is a scheme that can grow just as fast as biology grows, and I am of the opinion that nothing short of it could ever adequately represent a national centre of instruction and research in biology. Vast as the scheme is, at least in its possibilities, it is a true germ, all the principal parts of which could be realized in respectable beginnings in a very few years and at no enormous expense. With scarcely anything beyond our hands to work with, we have already succeeded in getting zoology and botany well started at Woods Hole, and physiology is ready to follow.

If now experimental biology could be started, even in a modest way, it would add immensely to the general attractions of our work, for it

would open a field which is comparatively new and of rapidly growing importance. There are so many things now called "experimental," that I must explain what I have in mind sufficiently to make the general purpose intelligible.

It is not that experimental embryology redundantly described as "developmental mechanics" which is now in vogue; not laboratory physiology, even in its wider application to animals; not egg-shaking, heteromorphism, heliotropism, and the like,—not any of these things, but experimental natural history, or biology, in its more general and comprehensive sense. It is not the natural history of the tourist or the museum collector or the systematist, but the modern natural history, for which Darwin laid the foundation, and which Semper, Romanes, Varigny, Weismann, Golton, Lloyd Morgan, and others have advocated and practised to the extent of the meager means at their command. The plan which I should propose, however, has not, so far as I am aware, been definitely formulated by any one, although some of its features were indicated several years ago when I proposed such a station in connection with the University of Chicago. The essentials of the plan were sketched as follows:

"Experimental biology represents not only an extension of physiological inquiry into all provinces of life, but also the application of its methods to morphological problems; in short, it covers the whole field in which physiology and morphology can work best hand in hand. . .

"A lake biological station, equipped for experimental work, would mark a new departure for which science is now ripe. Such a station has nowhere been provided, but its need has been felt and acknowledged by the foremost biologists of today. There are no problems in the whole range of biology of higher scientific interest or deeper practical import to humanity than those which centre in variation and heredity. For the solution of these problems and a thousand others that turn upon them, facilities for *long-continued experimental study, under conditions that admit of perfect control, must be provided*. Such facilities imply first of all material for study, and that nature here supplies in rich abundance. Then a convenient observatory with a scientific staff is required. In addition,—and this all-important,—there should be not only aquaria and plenty of running water, but also a number of ponds with a continuous supply of water, so arranged that the forms under observation could be bred and reared in isolation when necessary. Finally there should be room for keeping land animals and plants under favorable

conditions for cultivation and study. A station with such facilities as have been briefly indicated would furnish ideal conditions for the prosecution of research in nearly every department of biology, and especially in embryology and physiology."

If such a station could be developed in immediate connection with the plant already under way at Woods Hole, we might begin to realize what a biological station stands for.

We need to get more deeply saturated with the meaning of the word "biological," and to keep renewing our faith in it as a governing conception. Our centrifugal specialities have no justification except in the *ensemble*, and each one of them is prolific in grotesque absurdities, for which there is no correction in disconnection with the organic whole. But why talk of an organic whole, which no man can grasp, or make any pretension to mastering? Precisely that makes it necessary to talk and act as if we knew the fact, and as if our inability had not rendered us insensible to our need. Physiology is meaningless without morphology, and morphology equally so without physiology. Both find their meaning in biology, and in nothing less. What an absurdity was human anatomy without comparative anatomy; and comparative anatomy was only a much bigger absurdity until the general connection of things began to dawn in the conceptions of biology. Just think of a physiologist seriously proclaiming to the world that instinct reduces itself in the last analysis to heliotropism, steretropism and the like. The whole course of evolution drops out of sight altogether, and things are explained as if the organic world were a chemical creation only a few hours old. The absurdity would be no greater for a geologist to try to explain the earth without reference to its past history.

Think of a young morphologist, with all the advantages of the Naples station at hand, yes, within the walls of that grand station, loudly sneering at Darwinism, and spending his wit in derisive caricatures of general truths beyond the horizon of his special work and thought. And shall we forget the physiologist whose philosopher's stone is the search for his ancestry among the arachnids; or the anatomist who reverses his telescope to discover that his science begins and ends in terminology? And could we, much as we might yearn for such a benediction, forget the omnipresent and omniscient systematist, whose creed is summed up in priority?

The catholicon for crankiness has not been found, but in science there is but one cure where cure is possible; it is exposure to the full and

direct rays of the system as a whole. The application to the subject in hand is patent. The one great charm of a biological station must be the fullness with which it represents the biological system. Its power and efficacy diminish in geometrical ratio with every source of light excluded.

My plea, then, is for a biological station, and I believe that experimental biology would be the most important element in such a station. It is now possible to procure a favorable site, with land and freshwater privileges, in close proximity with the Marine Biological Laboratory, and with a moderate foundation to start with, the work could begin at any moment.

The project is certainly one of preeminent importance and for successful undertaking of that magnitude we need the active cooperation of American Naturalists. I bring the suggestion before you in the hope that it will enlist your interest and support.

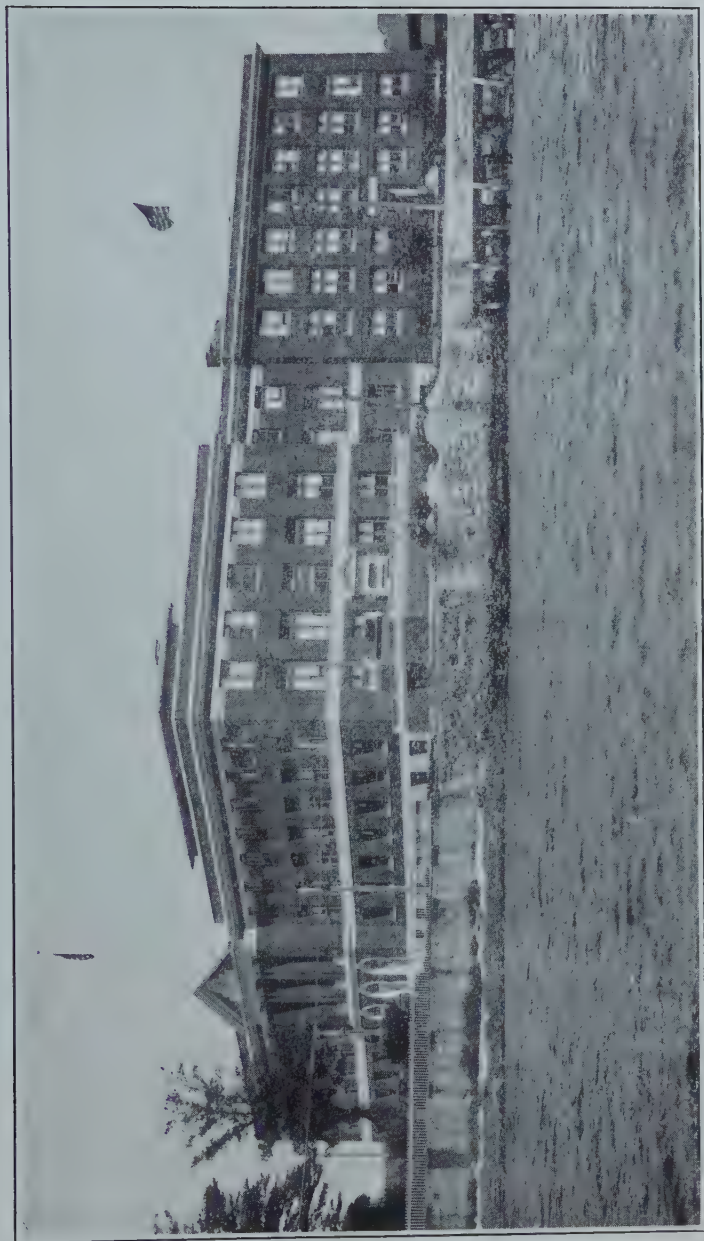
A SKETCH OF THE LIBRARY OF THE MARINE BIOLOGICAL LABORATORY

Priscilla B. Montgomery, Librarian

This paper is reproduced here by special permission of *The Collecting Net* and taken from the issue of July 6, 1929.

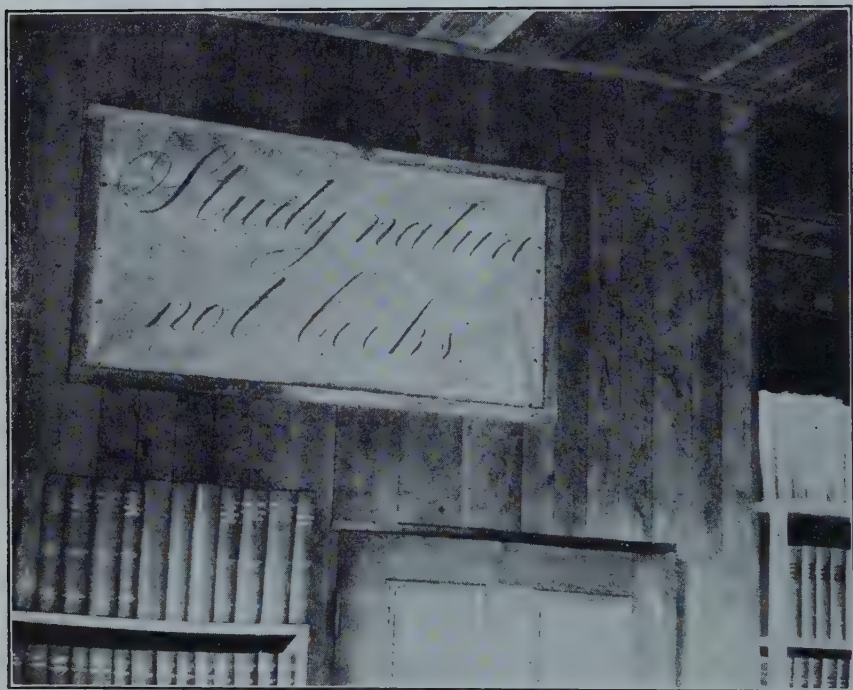
Nineteen hundred and twenty-eight, as everyone knows, was the 40th year of the Marine Biological Laboratory at Woods Hole, and the Library shared in this 40th anniversary. The fact that a permanent library is an essential element in a research laboratory was not kept in the back-ground by the Founders of the Laboratory, by the Trustees, or by Dr. Whitman, as a development that could come later. Indeed, a "small reference library" is mentioned in the "First Public Circular, 1888". The lower floor of the original two-story building (see picture) which was used for two years, without additions, was designed for "students receiving instruction" and the "upper story exclusively for investigators". It has been so far impossible for the writer to ascertain whether the small reference library that is mentioned along with other requisite assets such as "boats", "dredges", "running water", and "alcohol", was limited to reference texts, and so used during the first season solely for teaching. Since, however, the Trustees in their first Annual Report "are much indebted to the Boston Society of Natural History, to Mrs. R. H. Richards, and to others for aid in connection with the library, it is probable that from the very first season there were volumes of journals and monographs assigned a shelf in the upper sanctum or research laboratory; whereas only reference books used by instructors and students were kept on the floor below. At any rate, we know that before the second season, a "small library" was partitioned off on the southeast side of the upper laboratory floor at the same time that "eight private rooms for investigators" were divided off on the north side.

To Dr. Whitman, the library was regarded as essential to the materialization of the "*permanent staff of investigators*" for whose organization into a marine biological laboratory he eloquently pleaded in his address at the opening of the Laboratory in its first season. He said:



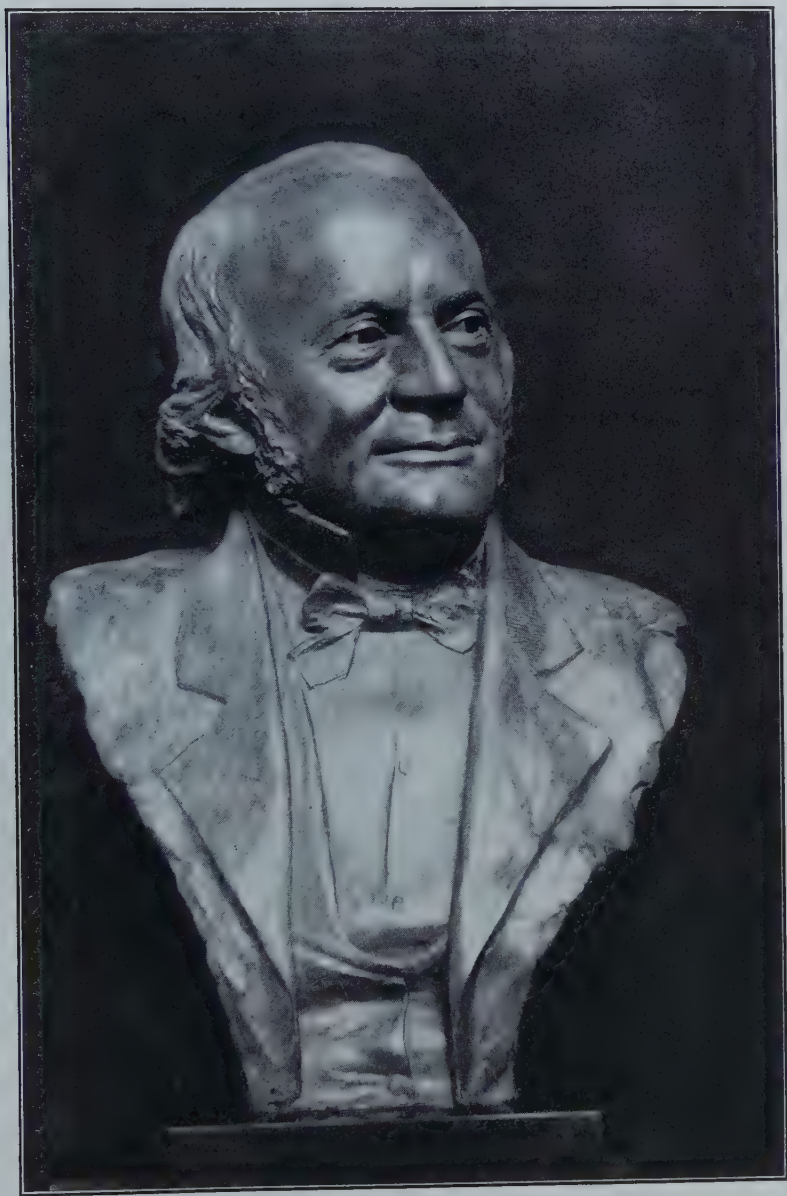
NEW MAIN BUILDING MARINE BIOLOGICAL LABORATORY

(Photo loaned by the *Collecting Net*)



THE OLD AGASSIZ MOTTO

(Cut loaned by the *Collecting Net*)



JEAN LOUIS RUDOLPHE AGASSIZ

Who 56 years ago founded the Andersen school of Natural History on the Island of Penikese which was the forerunner of the Marine Biological Laboratory. The bust was unveiled in the Hall of Fame in 1928 and is the work of Anna Vaughan Hyatt.

(Cut loaned by the *Scientific Monthly*)



THE MARINE BIOLOGICAL LABORATORY IN 1888

(Cut loaned by the *Collecting Net*)

"The ideal building should have extensive aquarium facilities, a comprehensive library, an auditorium, a spacious general laboratory for instruction, and a number of private rooms for investigation. Ample means should eventually be provided for the maintenance of serial and monographical publications". In his report of the first season he stressed in strong words this plea for help for a library: "A library is a necessity in such a laboratory, and it must be provided for in one way or another. Boston libraries are near enough to be of great service, but we cannot depend on them alone. In addition to textbooks and standard works of reference, we must have as a minimum to begin with all the important journals now printed in the four principal languages. It is most earnestly to be hoped that adequate means may be found to meet this all-important requisite". This paragraph numbers third among five, in each of which he enumerated important necessities for the next season.

Dr. Whitman's skilful presentation of the pressing necessities brought fruitful results at once. Before the summer of 1889, the Library, a sunny corner with one window, was, according to the Announcement of 1889, "provided henceforth with not only the ordinary text-books, and works of reference, but also with the more important journals of zoology and botany and many of them in complete series". The Trustees in their report elucidate: "The Library has grown into a very valuable collection of books, chiefly long series of journals. This valuable addition to our equipment we owe principally to Mrs. Glendower Evans' liberality for which we make most grateful acknowledgement. She deposited with us one thousand dollars worth of biological works, which were selected by the committee of the Trustees especially for the Laboratory. Other books have been purchased from the general funds of the Laboratory. Important accessions have been made by gift. The details are given in the report of the Library". A six-page report of the Library Committee followed and was signed by Dr. Charles S. Minot, Chairman; Professor W. T. Sedgwick and Professor C. O. Whitman. Even at that time efforts were made to secure the "largest possible series of biological journals, and as many pamphlets as we can". By the Fall of 1889, there were in the Library 343 volumes and 525 pamphlets arranged and catalogued. Nearly all this work was done without expense to the Laboratory".

It is impossible to resist giving a list of the journals that were at this time, the second year of the Laboratory, already started in current

subscription, never to be dropped. There were, as far as one can be sure, twenty-two titles:

Anatomischer Anzeiger
Annales des Sciences Naturelles, Botanique
Annales des Sciences Naturelles, Zoologie
Annals of Botany
Arbeiten aus den Zoologischen Instituten der Universitat Wien
Archiv fur Anatomie und Physiologie
Archiv fur Mikroskopische Anatomie
Archives de Biologie
Archives de Zoologie Experimentale et Generale
Botanical Gazette
Botanische Zeitung
La Cellule
Gegenbaurs Morphologisches Jahrbuch
Jahrbucher fur wissenschaftliche Botanik
Jenaische Zeitschrift fur Naturwissenschaft
Just's Botanischer Jahresbericht
Mitteilungen aus der Zoologischen Station zu Neapel
Quarterly Journal of Microscopical Science
Zeitschrift fur Wissenschaftliche Mikroskopie
Zeitschrift fur Wissenschaftliche Zoologie
Zoologische Jahrbucher
Zoologischer Jahresbericht

It would be interesting to know whether or not Wilhelm Roux' *Archiv fur Entwicklungsgeschichte* was subscribed to at its inception in 1895. Certainly it was begun very soon, since the complete set was in the Library in 1913. That Roux' *Archiv* was here practically at its beginning and the *Zeitschrift fur Physikalische Chemie* as early as 1920, is an interesting indication of the kind of work being done at the Laboratory.

The precision with which the Library's forty years fall into ten-year periods, each with its own peculiar characteristics, is most interesting. Each of the decades has a peak of perfection of accomplishment, and each peak curiously enough represents a special regime and contribution to the growth of the Library. During the first ten years, the Trustees, through a representative committee or person as Librarian, seem to have dominated the Library in a way never afterward apparent. The first report of the Library as stated above, was signed by three

Trustees, and one or another of these men would seem to have administered the one thousand dollars presented by Mrs. Evans, and actually purchased the volumes for the Library. In following years, Professor MacMurrick (1891) and Dr. Jordan (1892) each served as Librarian and finally in 1893, before the end of the first decade and in the spirit of careful trustee-like care, Dr. Clapp undertook the responsible task. She carried the Library through the close of the year of 1898, when the Trustees, probably because of the vision in mind of what it must attain in order to contribute to the success of the Laboratory, personally sponsored the young library so thoughtfully started on its way. The Library throughout the first ten years was, in fact, a very personal affair not only of the Trustees, but also of the investigators as a whole. Unless they or their friends gave time and money, the Library was not to get on very far. Dr. Whitman's own solicitude and interest, as shown by his reports, never flagged or failed.

Building additions were going on rapidly in these years and the Library was destined to live but one year in the original corner cupboard. The first ell was erected in the spring of 1890 and contained "a comfortable and convenient lecture-room, a pleasant library, and six investigators' rooms."

The new place given the Library in the upper story of this wing (the room where Dr. Calkins now gives his protozoology course) was evidently truly described in the Trustees' report as "pleasant", for the Library did not again move until the Crane Building was erected in 1914. It was hospitably forced to share space with investigators' work tables on critically crowded seasons before new buildings containing research rooms were periodically erected: the second wing (1892); the Botany Building (1894); the Lecture Hall (1896); etc. The motto, with Louis Agassiz's signature in one corner, "Study Nature, Not Books" is still to be seen over the door of this Laboratory. An investigator, sentimental, but not lacking in whimsicality, had rescued it from its place on the wall of the Penikese Laboratory and placed it here sometime about 1897. Its historic and sentimental value will increase with the years, and it has been suggested that the scroll, now about fifty years old, should be framed for preservation and hung perhaps in the reading room over the periodical racks.

Another expression of the extreme importance of the library end of a laboratory, was shown in 1894 by the Trustees in establishing an endowment fund for the Library. This sum, about five hundred dollars,

was invested as a fund to be used when the Laboratory should be permanently established and the Library safely housed. The accumulated fund, amounting in all to \$2,866.86, was actually spent in the years 1924-25 for serial back sets so that they were already in hand in the spring of the latter year for the moving into our present roomy quarters.

In the next ten-year period (1898-1908), the personal interest in the Library was evidently more general among the various members of the Corporation. Dr. Clapp retained the position of Librarian throughout this second decade and gave her fullest report of the attainments of the Library in 1895. She continued her careful watch over the Library, and with help from her band of faithful students, recorded with precision the steadily increasing volumes and reprints that came in through purchase and gift. One can but wish that Dr. Clapp would tell the story, as she alone could, of the atmosphere of the laboratory-reading-room Library as it was in those days. It must have been a gathering spot for discussion and for many a hot argument. Students passing through or working near by must often have shared the soothing environs when peace pipes were being indulged or been sympathetically roused and even secretly shocked by fiery words and other expressions of high debate.

At the end of the second decade of the Library (1908), there were recorded in the accession book of the Library 1745 volumes and 1500 reprints. The report of gifts in 1900 makes special mention of twelve important journal publications that were regularly presented. The *Zoological Bulletin* was begun in 1898, but no allusion is made to any exchange of publications until 1908, when Dr. Lillie in his first report as Director, suggests the importance of building up this method for acquiring important publications.

In 1908, a year of many changes for the Laboratory, Dr. Knower accepted the post of Librarian and continued in this capacity until 1919. During the years 1908-1913, he worked alone or with the help of a janitor in the spring before his arrival, or had a local part-time helper in the summer. During these years there is no single official report of the Library, but the regular expenditures for the journal subscriptions are recorded in the Treasurer's report, and many gifts and new exchanges were undoubtedly brought into the Library. But in 1913, the plans for a new building were on foot, and Dr. Knower brought to light in an official report a reflection of his characteristic enthusiasm.

No one could ever again put quite the force back of a request that he so tactfully applied to the workers and their friends here. He started

many of the springs from which the gifts and interest in the Library have continued to contribute to the material equipment and the spirit of the Library. The publishers' giving their books as an advertisement was initiated by him, and in 1916, 39 books, representing a sum of \$250, were presented. He secured the Carnegie Institution publications and, true to the original idea of the Founders of the Laboratory, spared no pains and incidentally no persons, from his begging list, in order to work up a sum of money each year to have the Library secure one or more new journals on its subscription list. In 1916 by personal appeal Dr. Knowler secured \$108 from the investigators for new current subscriptions to journals. Sixty individuals contributed to this fund that year, the largest manifestation of cooperation toward the Library, I believe, in its history. Four years previously Dr. Knowler had initiated this method of raising money and though his energy and enthusiasm attained such high reward but the one year, the seed he then sowed still brings forth fruit.

In 1914, the Library was moved into the beautiful room in the new Crane Building overlooking the Sound and the Vineyard. At its east end were two library offices for the Assistant Librarian, Miss Mary Scott, then newly appointed; and at the other end, a research laboratory room for Dr. Knowler. Immediately after the occupancy of the new Library in 1914, Dr. Knowler urged the Library by leaps and bounds in the direction of securing back sets of serials, new current periodicals, and reprints. Through Dr. Ralph W. Tower of The American Museum of Natural History a long-time loan was arranged by which 1723 volumes came into the Library; 466 volumes were presented by the Wisconsin Academy of Sciences. In 1915, there were twenty-nine exchanges with the Biological Bulletin. The total number of current serials, so earnestly worked for by the Librarian, mounted to about 150. Withal, the volumes in the Library at the end of 1918 numbered about 8500 and prints 8000. The budget during this time was of course much larger than during the first twenty years, when all was housed in the old wooden building. It averaged about two thousand dollars a year in contrast to five hundred a year in the former periods.

The history of the period between 1909 and 1918 when Dr. Knowler served as Librarian to the Laboratory Corporation shows gains in material holdings and in their handling, but the marked aspect of these ten years is the cooperative spirit shown by the investigators.

If there were changes initiated in the Library atmosphere during the third decade, there were radical changes during the fourth. The Library's three-word description, "a comprehensive library," formed a part of a sentence in the first Announcement, in 1888; grew to a full sentence in a paragraph description of laboratory equipment in 1889; was stationed by itself with a "Library" heading in 1895; and finally, in 1899, a paragraph to appeal for assistance was added, and thus it remained along with "General Information", "Lectures and Seminars", "Supply Department", etc., for twenty years without change. Then suddenly in 1920, the idea of efficiency was evidently introduced and the Announcement became very orderly—departments of "Research and Instruction" and "Service" separated off, and the Library, along with Mr. Gray's Supply Department and the Chemical Room were relegated as *service departments*.

If a time had come for the Library to become a business of the Laboratory no better person could have taken charge than Dr. Bigelow. His point of view was to combine a knowledge of the research workers' needs, with up-to-date library technique, and to make use of a sound business method. In 1919, Dr. Bigelow accepted the post of Librarian, and in the same summer the present Librarian became Assistant. Dr. Bigelow withdrew in 1922 in order to have more time for his research. But the period 1919-1928 is imbued, one hopes, with the same spirit in which it was started by Dr. Bigelow. The years 1922-1928 are marked by the active cooperation with the Librarian of a strong Library Committee. This Committee still functions and consists of the following members:

Dr. C. E. McClung, *Chairman*; Drs. M. M. Metcalf, J. R. Schramm, E. E. Just, R. A. Budington, Charles J. Fish, A. H. Sturtevant and Selig Hecht.

After the expenditure of the Library Fund in 1894-95, Dr. Lillie secured from the General Education Board a sum of fifty thousand dollars for the purchase of back sets and monograph reference works. In the last decade (1919-28) about \$86,000 have been spent in permanent equipment and over \$41,000 in service; a total of about \$137,000. Eighteen thousand volumes and 43,000 reprints have been put away for use.

TWO-HEADED FISH

By Bert Cunningham, Professor of Biology, Duke University

Monsters have always held a peculiar fascination for mankind. In earlier times the observed monsters such as two-headed snakes probably served as a basis for imaginary depiction of the many-headed reptiles of mythology.

When monsters occurred among humans it became necessary to explain them, and thus arises much of our folk-lore of pre-natal influences and birth marks. The discussion of this phase of psychic development would require a complete volume.

Among the earliest reports of any authenticity of monsters are those of Aristotle among which he describes two-headed serpents. So far as I have been able to discover, Aristotle did not describe any two-headed fish, although he was fairly conversant with the group as is shown by his work on sharks and *Echineis*.

The earliest reference to two-headed fish seems to be that of Aldrovandi in 1642. This was an unusual story, and I believe its authenticity may be doubted.

In 1912 Gemmill published a monograph upon "The Teratology of Fishes". In this volume he has assembled a great number of all types of cases, and includes in the work a bibliography of some 276 titles. For details of occurrence, for structural types, and detail anatomy, the reader is referred to the above volume.

Last summer I received from a friend who knew I was interested in monsters, a few fish from a hatchery in western North Carolina. Not knowing at that time of the previous work, I became much interested in their general anatomy. By sectioning I secured many figures which later proved to be very similar to those in Gemmill's book. Further correspondence with the superintendent of the station, Mr. F. J. Rieger, indicates that the phenomenon is fairly common in brook trout fry, the occurrence rate being about 1 to 2,000-3,000.

The accompanying cut (p. 24) taken from a photograph, shows the more typical external forms of the monsters although a large number of other types may occur.

The cause of duplicity is rather fully discussed by Gemmill who believes that the final factor is "inherent in the fertilized germ cell". His argument that it is not environmental, is based upon the fact that under exactly the same environmental factors of heat, light, and salinity

some eggs produce monsters while others do not. That these double monsters can not be attributed to early partial separation of the blastomeres as in the *Triton* is evident. What appears to be more likely is that these monsters are produced by either multiple egg nuclei upon a single yolk, each of which produces an embryo which becomes mutually engrafted in development, thus producing all types of monsters, or it may be possible that the yolks, each bearing a single ovum become fused before leaving the ovary.

These animals rarely reach any size according to Mr. Rieger. Experience in hatcheries show that they die early. We have reasons therefore, for doubting the great size of the two-headed fish cited by Aldrovandi.



TYPICAL EXTERNAL FORMS OF TWO-HEADED FISH

Phi Sigma Society

National Council

May 10, 1929.

To the Chapters of Phi Sigma:

The Council will be very glad to have your chapter consider the following matter:

IS A CHANGE IN THE CONVENTION PLAN ADVISABLE?

It has been suggested in the recent chapter letter of Zeta Chapter (see the *Biologist*, X, No. 3, Pages 22-3) that fewer conventions might suffice for transaction of the Society's business. Since the receipt of this letter, definite suggestions have been offered that National Conventions be held only once in four years instead of once in two years as at present. If this were done, it should be possible to devote a respectable sum now used for convention purposes to distribution for research grants.

Such a change, providing it meets the approval of the Chapters, will naturally require a constitutional amendment. It has been suggested that if the change were made, the Chapters might wish to select regional representatives, perhaps five in number, to sit with the Council at least once during the interval between conventions. In lieu of such a group, perhaps a systematic plan of visits to the Chapters by members of the Council might be preferred.

In any decision on the above question it must be borne in mind that many chapters seem to derive considerable stimulus and benefit from the present system of conventions every two years.

Please consider this matter in your next chapter meeting if possible and report the sentiment of your chapter.

Very truly yours,

PAUL B. SEARS,
National President.

Chapter Secretaries please note—

To date the results of only seven chapter votes on the question in the above letter have been received. The National Council requests that this matter be considered and voted upon at the first chapter meeting this fall and the results forwarded without unnecessary delay.



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Order all keys direct from the L. G. Balfour Co., of Attleboro, Mass., through either the chapter Secretary or Treasurer. Accompany all orders with the name (plainly printed) of the person for whom the key is intended, the chapter to which he belongs and the date of his initiation.

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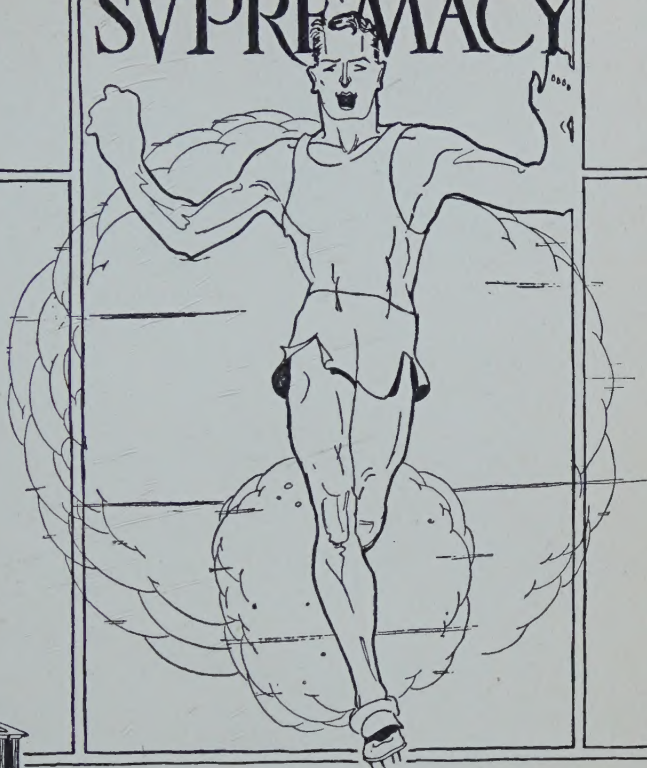
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